Metal and Organochlorine Residues in Fish from Lake Dauphin, Manitoba, 1984

Water Standards and Studies Report #86-4

Manitoba
Environment and
Workplace Safety
and Health

METAL AND ORGANOCHLORINE RESIDUES IN FISH FROM LAKE DAUPHIN, MANITOBA; 1984

A. E. Beck
Water Standards and Studies Section
Environmental Management Services Branch
Environmental Management Division

DEPARTMENT OF ENVIRONMENT, AND WORKPLACE SAFETY AND HEALTH

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SUMMARY

A joint federal-provincial effort to rehabilitate the Lake Dauphin fishery began in 1981. The project's high local profile prompted some concerns regarding chemical residues in fish from Lake Dauphin. Water Standards and Studies Section was informally requested to address the issue.

A total of 127 specimens were collected by field staff of Fisheries and Oceans Canada. The specimens were forwarded to Water Standards and Studies by regional staff of Manitoba Natural Resources. Analyses of specimens were performed by the W. M. Ward Technical Services Laboratory.

Muscle tissue residues of all analytes including arsenic, mercury, PCB and DDT were found not to exceed existing federal limits. Muscle tissue residues of metals such as cadmium, chromium, copper, lead, mercury and nickel compared favourably to levels encountered in pristine northern water bodies such as Gods Lake. However, compared to residues encountered in fish from major rivers of southern Manitoba, residues of arsenic and zinc appeared slightly elevated. This was attributed to normal runoff from the watershed and to the fertility and productivity of Lake Dauphin, respectively.

Residues of PCB were not detected in any of the samples analyzed. Excepting dieldrin, muscle tissue residues of the organochlorines analyzed were lower than residues typically encountered in major rivers of southern Manitoba.

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1.0 INTRODUCTION

The Dauphin Lake Fisheries Enhancement Project is a joint federal-provincial effort to rehabilitate the Lake Dauphin fishery. The project was formally initiated in 1981 with the signing of a Memorandum of Understanding by officers of the Canada Department of Fisheries and Oceans and of the Manitoba Department of Natural Resources.

One aspect peripheral to the joint project but which was of some concern to local persons involved the question of chemical residues in Lake Dauphin fish. Because of previous experience with similar concerns in water bodies such as the Red, Assiniboine and Winnipeg Rivers, Water Standards and Studies Section of Manitoba Environmental Management Division was informally requested by regional Resources staff to address the issue of residues in fish. Water Standards and Studies Section agreed to participate to the full extent of existing analytical capabilities at provincial facilities. This commitment was made to involved parties in June, 1984.

The present study was restricted to an examination of only those substances for which provincial analytical capabilities existed. Therefore, some of the agricultural chemicals commonly in use in Manitoba agriculture were not included in the present study. This was despite recent evidence that residues of chemicals such as trifluralin and triallate have been detected in fish from an other Manitoba watershed (D. Williamson, pers. comm.).

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* D. Williamson, Environment Officer, Water Standards and Studies, Environment and Workplace Safety and Health.

2.0 METHODS

A maximum of twenty-five specimens per common species was required for the study. Staff of the local Department of Fisheries and Oceans field station collected the specimens by net from the southern area of Lake Dauphin. Freezer storage of specimens and subsequent shipment to the Water Standards and Studies Section in Winnipeg was arranged by regional staff of the Department of Natural Resources.

Specimens were processed by the Water Standards and Studies Section. Specimens were assigned an identification number, identified to species, weighed to the nearest 20g and measured (fork length) to the nearest 0.1 cm. Evidence of age was removed during processing. These consisted of otoliths (bone structures located at the base of the brain) for walleye, yellow perch and cisco, leading rays from the dextral pelvic fin for suckers, and cleithra (a bone adjacent to the gill) for northern pike. Samples of skinless, boneless fillet were removed from each specimen and placed into appropriately labelled whirlpaks (for metal analysis) and precleaned* glass jars (for organochlorine analysis).

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* New 250 ml. glass jars were triple rinsed with pesticide-grade acetone and then triple rinsed with pesticide-grade hexane. A similarly rinsed liner of aluminum foil was placed between the jar and cap. This procedure was performed by staff of the W. M. Ward Technical Services Laboratory.

Evidences of age were submitted to the Department of Natural Resources Fisheries Enhancement Branch for age determinations in a manner adapted from Lagler (1964) and Guerrier (1951). Fish muscle tissue samples were submitted to the W. M. Ward Technical Services Laboratory for final preparation and analysis according to Sorba et al (1980).

Samples for arsenic analysis were digested and dry ashed in the presence of nitric acid and magnesium oxide/nitrate solution. This converts organic forms of arsenic to inorganic arsenic. The inorganic arsenic was reacted with sodium borohydride to produce arsine gas. The hydride gas and hydrogen evolved was combusted and analyzed by atomic absorption spectroscopy*.

Samples destined for metals analyses were dried and then ashed in a muffle furnace. The ash was dissolved in concentrated hydrochloric acid, diluted to volume and analyzed by direct aspiration using atomic absorption spectroscopy*.

Samples for organochlorine analysis require more extensive preparation. (P. Nicolas, pers. comm.). Ten grams of sample was added to acetonitrile-water and homogenized using a polytron blender. The homogenate was then centrifuged. The supernatant was transferred to a 2 litre separatory funnel, diluted with water, and extracted with petroleum ether. The extract was concentrated, cleaned with florisil and then concentrated to five milliliters. Analysis was performed using a gas chromatograph equipped with an electron capture detector*.

Detected residues were reported as µg/g (wet weight).

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* Accuracy and precision data are available on request from:
W. M. Ward Technical Services Laboratory,
Attn: E. A. Sorba, Head, Methods and Standards Section,
745 Logan Avenue, Winnipeg, Manitoba. R3E 1M8

3.0 RESULTS AND DISCUSSION

Data from arsenic and metals analysis and from organochlorine analysis are tabulated in Appendices I and II, respectively.

3.1 Arsenic and Metals

Although properly not a metal, arsenic has been grouped with the metals for the purposes of the present report, because, it too is an element which can have toxic effects. Arsenic and metals residues data have been summarized in Table 1.

Mean arsenic residues ranged from 0.02 µg/g in yellow perch and northern pike to 0.15 µg/g in cisco (tullibee). The maximum individual residue encountered, (0.71 µg/g), was detected in a walleye. All residues were well below the federal limit for arsenic (50 µg/g) in commercial fish. Comparatively, fish from the Red, Souris and Assiniboine Rivers, which also drain agricultural areas, generally demonstrated mean arsenic residues of 0.05 µg/g or less (Water Standards and Studies, unpublished data). Fish from Herblet Lake, a water body which received moderate arsenic loading to the water column and sediments, demonstrated mean arsenic residues in fish muscle tissue which ranged from 0.15 µg/g in common sucker to 0.47 µg/g in northern pike (Beck, 1984a). The inference drawn from these comparisons was that minor arsenic loading to Lake Dauphin had occurred. Since a 1982 water quality survey of eleven sites within the Valley River watershed detected trace arsenic residues at nine locations (Hughes, 1984), this minor loading to Lake Dauphin was attributed to natural runoff from the watershed.

TABLE 1: SUMMARY OF GENERAL PHYSICAL MERISTICS AND MUSCLE TISSUE METAL RESIDUES IN FISH FROM LAKE DAUPHIN, 1984

FISH SPECIES (N)*	LENGTH (cm)	WEIGHT (g)	SEX (M:F)	AGE (YRS)	MUSCLE TISSUE METAL RESIDUES (µg/g) ARSENIC	CADMIUM	CHROMIUM	COPPER	LEAD	MERCURY	NICKEL	ZINC	STATISTIC
	43.5	1140.	0.22	5	0.10	<0.1	<0.5	0.4	<0.5	0.10	<0.5	4.7	$\bar{x}$
WALLEYE	6.08	408.7	-	1.4	0.173	0	0	0.21	0	0.035	0	0.58	σ
(N=25)	59.3	2660.	-	10	0.71	0.1	<0.5	1.1	0.5	0.24	<0.5	5.8	Hi
	20.2	120.	-	1.	0.03	<0.1	<0.5	<0.2	<0.5	0.05	<0.5	3.4	Lo
	-	-	-	-	0	0.95	1.0	0.16	0.96	0	1.0	0	F
	50.2	937.	0.53	4	0.02	<0.1	<0.5	0.5	<0.5	0.14	<0.5	6.4	$\bar{x}$
NORTHERN	2.96	156.9	-	1.0	0.012	0	0	0.24	0	0.097	0	1.44	σ
PIKE	55.5	1220.	-	7	0.06	<0.1	<0.5	1.2	0.5	0.40	<0.5	10.0	Hi
(N=23)	44.3	600.	-	3	<0.01	<0.1	<0.5	0.3	<0.5	0.05	<0.5	4.4	Lo
	-	-	-	-	0.04	1.0	1.0	0	0.83	0	1.0	0	F
	23.2	222	0.17	5	0.02	<0.1	<0.5	0.2	<0.5	0.07	<0.5	6.1	$\bar{x}$
YELLOW	1.42	52.0	-	1.1	0.009	0	0	0.04	0	0.029	0	0.75	σ
PERCH	27.0	350.	-	8	0.04	<0.1	<0.5	0.3	<0.5	0.15	<0.5	7.7	Hi
(N=21)	20.6	110.	-	3	<0.01	<0.1	<0.5	<0.2	<0.5	0.05	<0.5	4.6	Lo
	-	-	-	-	0.48	1.0	1.0	0.81	1.0	0	1.0	0	F
	36.0	764.	0.91	5	0.05	<0.1	<0.5	0.5	<0.5	0.04	<0.5	4.5	$\bar{x}$
COMMON	2.85	148.0	-	1.5	0.021	0	0	0.20	0	0.018	0	0.72	σ
SUCKER	42.9	1160.	-	9	0.11	<0.1	<0.1	0.9	<0.5	0.08	<0.5	6.2	Hi
(N=25)	29.3	440.	-	2	0.01	<0.1	<0.1	0.3	<0.5	<0.02	<0.5	3.2	Lo
	-	-	-	-	0	1.0	1.0	0	1.0	0.08	1.0	0	F
	32.5	579.	1.57	6	0.09	<0.1	<0.5	0.3	<0.5	0.06	<0.5	5.2	$\bar{x}$
SHORTHEAD	3.72	179.4	-	2.3	0.014	0	0	0.14	0	0.037	0	1.01	σ
REDHORSE	39.2	970.	-	12	0.12	<0.1	<0.5	0.6	0.5	0.20	<0.5	7.6	Hi
SUCKER	26.1	320.	-	3	0.06	<0.1	<0.5	<0.2	<0.5	0.02	<0.5	3.6	Lo
(N=21)	-	-	-	-	0	1.0	1.0	0.33	0.90	0	1.0	0	F
	25.1	293.	1.0	5	0.15	<0.1	<0.5	0.4	<0.5	0.02	<0.5	7.4	$\bar{x}$
CISCO	1.67	62.1	-	1.0	0.053	0	0	0.20	0	0.003	0	1.82	σ
(N=12)	27.3	400.	-	6	0.28	<0.1	<0.5	0.7	0.5	0.03	<0.5	10.8	Hi
	22.2	210.	-	3	0.07	<0.1	<0.5	<0.2	<0.5	<0.02	<0.5	5.0	Lo
	-	-	-	-	0	1.0	1.0	0.08	0.92	0.67	1.0	0	F

* KEY TO SYMBOLS:
- < - less than, indicates lower limit of detection
- $\bar{x}$ - mean or average value
- σ - standard deviation
- Hi - greatest value encountered
- Lo - smallest value encountered
- F - frequency of "L" values, expressed as a ratio

A trace of cadmium was detected in a single walleye. None of the remaining one hundred twenty six specimens demonstrated detectable residues of cadmium. The less than one percent frequency of detection was similar to detection frequencies in specimens from the Red, Souris and Assiniboine Rivers (Water Standards and Studies, unpublished data) and compares favourably to data from pristine northern water bodies such as Gods Lake (Beck, 1982).

Residues of chromium and nickel were not detected in any Lake Dauphin specimens. This was typical of southern Manitoba watersheds (Water Standards and Studies, unpublished data).

Copper residues were detected in 87% of the specimens. This was similar to detection frequencies in specimens from the Red, Souris and Assiniboine Rivers (Water Standards and Studies, unpublished data). Mean residues ranged from 0.2 µg/g in yellow perch to 0.5 µg/g in northern pike and common sucker. The maximum residue encountered, 1.2 µg/g, was detected in a northern pike. All residues were well below the federal limit of 100 µg/g for copper residues in commercial fish. Both mean residues and the range of individual specimen residues compared well with data from southern Manitoba rivers (Ibid) and from water bodies such as Gods Lake (Beck, 1982).

Lead was detected in only 6.3% of the specimens from Lake Dauphin. The frequency of detection was considerably less than the mean of 31% for specimens from rivers within agricultural watersheds (Brown and Beck, 1986) and was more comparable with results from Gods Lake (Beck, 1982). The individual maximum residues

encountered did not exceed the 0.5 µg/g analytical detection level and therefore, were well below the federal limit of 10.0 µg/g for lead residues in commercial fish.

Mercury has frequently been a cause for concern in some southern Manitoba watersheds (Beck, 1984(b)). The mercury data from Lake Dauphin indicated no cause for concern. Mean mercury residues ranged from 0.02 µg/g in cisco to 0.14 µg/g in northern pike. Similar results from the federal commercial fisheries inspection program have resulted in placement of the Lake Dauphin commercial fishery within the preferred "Monitor" classification (Fisheries and Oceans, 1984)*. The maximum residue encountered, 0.40 µg/g, was detected in a northern pike. All residues were below the federal limit of 0.50 µg/g for mercury residues in commercial fish. Both the mean residues encountered and individual specimen maximums were considerably lower than those routinely encountered in the major southern Manitoba rivers (Beck, 1984(b)) and were comparable to mercury residues typically encountered in specimens from Gods Lake (Beck, 1982).

Mean zinc residues ranged from 4.5 µg/g in common sucker to 7.4 µg/g in cisco. The maximum residue encountered, 10.8 µg/g, was detected in a cisco. Although all residues were well below the federal limit of 100 µg/g for zinc residues in fish muscle tissue, both mean residues and individual maximums exceeded values typically

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* Locations producing fish which occasionally or frequently possess mercury concentrations in excess of the 0.50 µg/g limit may be classified as "Detain" or "Sample each shipment".

encountered in major southern Manitoba rivers (Water Standards and Studies, unpublished data) and in pristine water bodies such as Gods Lake (Beck, 1982). However, excessive loadings of zinc to Lake Dauphin were not indicated. Phytoplankton bioconcentration of water column zinc is well known (Spear, 1981) and is an important vector for the accumulation of zinc in fish (Jackson, 1978). Thus the productivity of Lake Dauphin's fertile waters may have enhanced the accumulation of zinc residues in the muscle tissues of Lake Dauphin fish.

3.2 Organochlorines

Polychlorinated biphenyls (PCB) and some persistent insecticides are included in the "organochlorine" designation. PCB and insecticide residues data have been summarized in Table 2. A synopsis of each of the organochlorine analytes has also been compiled (Appendix III).

3.2.1 PCB

The federal limit for PCB residues in fish destined for commercial sale in Canada has been set at 2.0 µg/g. Mean residue levels in some Great Lakes fish have exceeded the federal limit by factors of more than 2 times (Armstrong and Lutz, 1977). However, PCB residues encountered nearer to Lake Dauphin have been considerably lower. Specific statewide mean residues appeared not to exceed 0.6 µg/g in Minnesota fish (Helwig, 1983) and annual mean residues

TABLE 2: SUMMARY OF GENERAL PHYSICAL MERISTICS AND MUSCLE TISSUE ORGANOCHLORINE RESIDUES IN FISH FROM LAKE DAUPHIN, 1984*

FISH SPECIES (N)	LENGTH (cm)	WEIGHT (g)	SEX (M:F)	AGE (YRS)	MUSCLE TISSUE ORGANOCHLORINE RESIDUES (µg/g) DIELDRIN	TOTAL DDT	ppDDE	ppDDD	STATISTIC
	43.5	1140	0.22	5	0.0004	0.0016	0.0013	0.0010	$\bar{x}$
WALLEYE	6.08	408.7	-	1.4	0.00002	0.00104	0.00063	0.00007	σ
(N=25)	59.3	2660	-	10	0.0005	0.0042	0.0031	0.0013	Hi
	20.2	120	-	1	<0.0004	0.0006	0.0006	<0.001	Lo
	-	-	-	-	0.16	0	0	0.20	F
	50.2	937	0.53	4	<0.0004	0.0006	0.0006	<0.001	$\bar{x}$
NORTHERN	2.96	156.9	-	1.0	0	0.00052	0.00052	0	σ
PIKE	55.5	1220	-	7	<0.0004	0.0021	0.0021	<0.001	Hi
(N=23)	44.3	600	-	3	<0.0004	<0.0003	<0.0003	<0.001	Lo
	-	-	-	-	1.0	0.52	0.52	1.0	F
	23.2	222	0.17	5	<0.0004	<0.0003	<0.0003	<0.001	$\bar{x}$
YELLOW	1.42	52.0	-	1.1	0	0	0	0	σ
PERCH	27.0	350	-	8	<0.0004	<0.0003	<0.0003	<0.001	Hi
(N=21)	20.6	110	-	3	<0.0004	<0.0003	<0.0003	<0.001	Lo
	-	-	-	-	1.0	1.0	1.0	1.0	F
	36.0	764	0.91	5	<0.0004	0.0003	0.0003	<0.001	$\bar{x}$
COMMON	2.85	148.0	-	1.5	0	0	0	0	σ
SUCKER	42.9	1160	-	9	<0.0004	0.0007	0.0007	<0.001	Hi
(N=25)	29.3	440	-	2	<0.0004	<0.0003	<0.0003	<0.001	Lo
	-	-	-	-	1.0	0.96	0.96	1.0	F
	32.5	579	1.57	6	0.0004	0.0005	0.0005	<0.001	$\bar{x}$
SHORTHEAD	3.72	199.4	-	2.3	0.0007	0.00043	0.00043	0	σ
REDHORSE	39.2	970	-	12	0.0007	0.0019	0.0019	<0.001	Hi
SUCKER	26.1	320	-	3	<0.0004	<0.0003	<0.0003	<0.001	Lo
(N=21)	-	-	-	-	0.95	0.67	0.67	1.0	F
	25.1	293	1.0	5	0.0004	0.0018	0.0018	<0.001	$\bar{x}$
CISCO	1.67	62.1	-	1.0	0.00003	0.00113	0.00113	0	σ
(N=12)	27.3	400	-	6	0.0005	0.0039	0.0039	<0.001	Hi
	22.2	210	-	3	<0.0004	<0.0003	<0.0003	<0.001	Lo
	-	-	-	-	0.92	0.83	0.83	1.0	F

* - The following organochlorines were not detected in any of the samples analyzed and therefore are not included in the summary: Aroclor 1248, Aroclor 1254, Aroclor 1260, aldrin, chlordane, endrin, lindane, methoxychlor, opDDE, opDDD, opDDT and ppDDT.

KEY TO SYMBOLS:

- < - less than, indicates lower limit of detection
- $\bar{x}$ - mean or average value
- σ - standard deviation
- Hi - greatest value encountered
- Lo - smallest value encountered
- F - frequency of "L" values, expressed as a ratio

in fish from Manitoba reaches of the Red River did not exceed 0.50 µg/g (Beck, 1986). This was consistent with other southern Manitoba watersheds (Water Standards and Studies, unpublished data). Residues of PCB were not detected in any of the Lake Dauphin specimens analyzed.

3.2.2 Insecticides

Chromatograms of the Lake Dauphin specimens were analyzed for peaks peculiar to twelve persistent organochlorine insecticides. Residues of aldrin, chlordane, endrin, lindane, methoxychlor, opDDE, opDDD, opDDT and ppDDT were not detected*.

Trace residues of dieldrin were encountered in most walleye and in single specimens of shorthead redhorse sucker and cisco. Dieldrin residues were not detected in northern pike, yellow perch or common sucker. The maximum individual level encountered, 0.0007 µg/g, was detected in a shorthead redhorse sucker. All residues were well below the federal limit of 0.30 µg/g for dieldrin residues in commercial fish. Although commonly encountered in fish from the Missouri River, Minnesota (Helwig, 1983), dieldrin residues have not been detected in fish from the major rivers of southern Manitoba (Water Standards and Studies, unpublished data).

Residues of ppDDE and ppDDD were the sole insecticides of the DDT group that were detected. Residues were most frequently

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* A synopsis of the analytes is presented in Appendix III.

detected in walleye, but the maximum value encountered (0.0039 µg/g), was detected in a cisco. All residues detected were well below the federal limit of 5.0 µg/g for total DDT residues in commercial fish. Comparatively, Lake Dauphin residues appeared lower than values typically encountered in fish from the major rivers of southern Manitoba (Water Standards and Studies, unpublished data).

4.0 CONCLUSIONS

With respect to fish collected from Lake Dauphin during 1984, it was concluded that:

1. Muscle tissue residues of arsenic, metals and organochlorines analyzed did not exceed existing Canada guidelines for commercial sale of fish destined for human consumption within Canada.
2. Muscle tissue residues of cadmium, chromium, copper, lead, mercury and nickel were similar to those encountered in pristine northern lakes.
3. Muscle tissue residues of arsenic were indicative of minor arsenic loadings to Lake Dauphin and were attributable to normal runoff from the watershed.
4. Slightly elevated muscle tissue residues of zinc were a reflection of the fertility and productivity of Lake Dauphin.
5. Excepting dieldrin, muscle tissue residues of the organochlorines analyzed were lower than residues typically encountered in major rivers of southern Manitoba.

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APPENDIX I

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1.	Metal Residues in Fish from Lake Dauphin, 1984:	
1(a):	Walleye.....	17
1(b):	Northern Pike.....	18
1(c):	Yellow Perch.....	19
1(d):	Common Sucker.....	20
1(e):	Shorthead Redhorse Sucker.....	21
1(f):	Cisco.....	21

KEY TO SYMBOLS

OBS - observation or specimen number
LENGTH - expressed in centimetres
WEIGHT - expressed in grams
AGE - expressed in years
SEX - expressed numerically where 1 = immature, 2 = male, 3 = female, 4 = regenerate
< - symbol for "less than"; indicates limit of detection
AS(M) - arsenic residues expressed in µg/g
CD(M) - cadmium residues expressed in µg/g
CR(M) - chromium residues expressed in µg/g
CU(M) - copper residues expressed in µg/g
PB(M) - lead residues expressed in µg/g
HG(M) - mercury residues expressed in µg/g
NI(M) - nickel residues expressed in µg/g
ZN(M) - zinc residues expressed in µg/g
µg/g - micrograms per gram are equivalent to "parts per million"

Appendix 1(a)

YEAR=1984 SITE=LAKE DAUPHIN SPECIES=WALLEYE

---------- YEAR=84 SITE=BM037 SPECIES=17 ----------

OBS	LENGTH	WEIGHT	AGE	SEX	***** AS(M)	***** CD(M)	***** CR(M)	***** CU(M)	***** PB(M)	***** HG(M)	***** NI(M)	***** ZN(M)
1	42.1	880	5	3	0.03 L	0.1 L	0.5 L	0.2 L	0.5	0.13 L	0.5	4.4
2	42.9	1080	5	3	0.04 L	0.1 L	0.5 L	0.2 L	0.5	0.10 L	0.5	4.8
3	46.2	1200	5	2	0.71 L	0.1 L	0.5 L	0.2 L	0.5	0.08 L	0.5	4.2
4	43.3	1010	5	3	0.05 L	0.1 L	0.5	0.4 L	0.5	0.11 L	0.5	3.8
5	43.5	1040	5	3	0.05 L	0.1 L	0.5	0.6 L	0.5	0.12 L	0.5	5.6
6	45.2	1270	5	3	0.05 L	0.1 L	0.5	0.3 L	0.5	0.08 L	0.5	3.6
7	44.1	1130	5	3	0.05 L	0.1 L	0.5	0.3 L	0.5	0.12 L	0.5	5.1
8	44.1	1090	5	2	0.03 L	0.1 L	0.5	0.4 L	0.5	0.10 L	0.5	4.7
9	44.6	1120	5	2	0.03 L	0.1 L	0.5	0.4 L	0.5	0.13 L	0.5	5.1
10	42.8	960	5	2	0.05 L	0.1 L	0.5	0.6 L	0.5	0.12 L	0.5	4.6
11	45.3	1410	5	3	0.62 L	0.1 L	0.5	0.4 L	0.5	0.10 L	0.5	4.6
12	59.3	2660	10	3	0.03 L	0.1 L	0.5 L	0.2 L	0.5	0.24 L	0.5	5.8
13	44.2	1140	5	3	0.03 L	0.1 L	0.5	0.3 L	0.5	0.09 L	0.5	4.9
14	38.7	760	4	2	0.04 L	0.1 L	0.5	0.3 L	0.5	0.10 L	0.5	4.4
15	43.2	1060	5	3	0.04 L	0.1 L	0.5	0.4 L	0.5	0.15 L	0.5	4.8
16	41.6	920	4	3	0.04 L	0.1 L	0.5	0.4 L	0.5	0.09 L	0.5	4.8
17	44.9	1150	5	3	0.14 L	0.1 L	0.5	0.4 L	0.5	0.08 L	0.5	5.0
18	49.2	1480	6	3	0.03 L	0.1 L	0.5	0.4 L	0.5	0.09 L	0.5	3.4
19	42.7	1100	5	3	0.03 L	0.1 L	0.5	0.5 L	0.5	0.09 L	0.5	5.1
20	41.6	1080	6	3	0.03 L	0.1 L	0.5	0.3 L	0.5	0.09 L	0.5	3.8
21	43.0	980	6	4	0.05 L	0.1 L	0.5	0.4 L	0.5	0.10 L	0.5	5.0
22	44.2	1400	5	3	0.05	0.1 L	0.5	1.1	0.5	0.08 L	0.5	4.3
23	46.5	1260	5	3	0.07 L	0.1 L	0.5	0.6 L	0.5	0.08 L	0.5	4.9
24	44.8	1200	5	3	0.04 L	0.1 L	0.5	0.6 L	0.5	0.09 L	0.5	4.7
25	20.2	120	1	1	0.07 L	0.1 L	0.5	0.8 L	0.5	0.05 L	0.5	5.2

Appendix 1(b)

YEAR=1984 SITE=LAKE DAUPHIN SPECIES=NORTHERN PIKE

---------- YEAR=84 SITE=BM037 SPECIES=25 ----------

OBS	LENGTH	WEIGHT	AGE	SEX	*****	AS(M)	*****	CD(M)	*****	CR(M)	*****	CU(M)	*****	PB(M)	*****	HG(M)	*****	NI(M)	*****	ZN(M)
1	50.5	860	4	3		0.02	L	0.1	L	0.5		0.4	L	0.5		0.17	L	0.5		6.4
2	53.4	1160	4	3	L	0.01	L	0.1	L	0.5		0.5	L	0.5		0.13	L	0.5		6.8
3	50.6	1000	3	3		0.02	L	0.1	L	0.5		0.3	L	0.5		0.10	L	0.5		4.4
4	52.0	930	5	3		0.02	L	0.1	L	0.5		0.6	L	0.5		0.14	L	0.5		7.2
5	51.2	1010	4	3		0.03	L	0.1	L	0.5		0.5	L	0.5		0.10	L	0.5		6.8
6	53.1	1100	4	2		0.01	L	0.1	L	0.5		0.6		0.5		0.38	L	0.5		6.5
7	44.3	700	3	2		0.03	L	0.1	L	0.5		0.7		0.5		0.40	L	0.5		6.0
8	48.6	900	4	2		0.03	L	0.1	L	0.5		0.4	L	0.5		0.10	L	0.5		5.8
9	47.0	740	4	2		0.03	L	0.1	L	0.5		1.2	L	0.5		0.12	L	0.5		5.2
10	52.8	1060	4	3		0.03	L	0.1	L	0.5		1.1	L	0.5		0.27	L	0.5		6.3
11	45.3	600	3	2		0.03	L	0.1	L	0.5		0.6	L	0.5		0.05	L	0.5		6.9
12	55.5	1220	6	3		0.02	L	0.1	L	0.5		0.5	L	0.5		0.23	L	0.5		4.4
13	51.2	960	4	2		0.02	L	0.1	L	0.5		0.5	L	0.5		0.09	L	0.5		4.8
14	45.8	720	3	2		0.02	L	0.1	L	0.5		0.5	L	0.5		0.06	L	0.5		4.8
15	49.0	900	5	3		0.02	L	0.1	L	0.5		0.5	L	0.5		0.09	L	0.5		8.0
16	54.0	1140	4	3		0.02	L	0.1	L	0.5		0.8		0.5		0.08	L	0.5		10.0
17	49.3	880	5	2		0.06	L	0.1	L	0.5		0.3	L	0.5		0.07	L	0.5		6.4
18	49.6	950	4	3		0.01	L	0.1	L	0.5		0.3		0.5		0.09	L	0.5		9.6
19	48.6	1000	5	3		0.01	L	0.1	L	0.5		0.3	L	0.5		0.08	L	0.5		6.4
20	53.0	1080	4	3		0.01	L	0.1	L	0.5		0.4	L	0.5		0.11	L	0.5		5.1
21	50.4	860	4	3		0.02	L	0.1	L	0.5		0.4	L	0.5		0.10	L	0.5		7.4
22	52.3	980	7	3		0.03	L	0.1	L	0.5		0.3	L	0.5		0.23	L	0.5		5.6
23	47.0	800	3	3		0.04	L	0.1	L	0.5		0.3	L	0.5		0.06	L	0.5		5.8

Appendix 1(c)

YEAR=1984 SITE=LAKE DAUPHIN SPECIES=YELLOW PERCH

---------- YEAR=84 SITE=BM037 SPECIES=16 ----------

OBS	LENGTH	WEIGHT	AGE	SEX	*****	AS(M)	*****	CD(M)	*****	CR(M)	*****	CU(M)	*****	PB(M)	*****	HG(M)	*****	NI(M)	*****	ZN(M)
1	27.0	350	8	3		0.04	L	0.1	L	0.5	L	0.2	L	0.5		0.15	L	0.5		5.9
2	23.8	250	5	3	L	0.01	L	0.1	L	0.5	L	0.2	L	0.5		0.09	L	0.5		6.0
3	25.0	320	5	3	L	0.01	L	0.1	L	0.5	L	0.2	L	0.5		0.08	L	0.5		4.6
4	23.5	220	5	3	L	0.01	L	0.1	L	0.5		0.3	L	0.5		0.05	L	0.5		6.0
5	22.8	200	4	3	L	0.01	L	0.1	L	0.5	L	0.2	L	0.5		0.06	L	0.5		6.0
6	24.9	260	3	3	L	0.01	L	0.1	L	0.5	L	0.2	L	0.5		0.05	L	0.5		5.2
7	22.4	220	5	3		0.01	L	0.1	L	0.5		0.3	L	0.5		0.07	L	0.5		5.8
8	23.0	220	4	3		0.02	L	0.1	L	0.5	L	0.2	L	0.5		0.06	L	0.5		5.8
9	24.2	220	7	3		0.03	L	0.1	L	0.5		0.3	L	0.5		0.15	L	0.5		7.7
10	22.7	230	5	3	L	0.01	L	0.1	L	0.5	L	0.2	L	0.5		0.06	L	0.5		5.3
11	22.9	220	4	3	L	0.01	L	0.1	L	0.5		0.3	L	0.5		0.05	L	0.5		6.6
12	23.8	250	5	3		0.01	L	0.1	L	0.5	L	0.2	L	0.5		0.07	L	0.5		6.0
13	23.3	210	4	3	L	0.01	L	0.1	L	0.5	L	0.2	L	0.5		0.05	L	0.5		7.2
14	22.3	200	6	2		0.02	L	0.1	L	0.5	L	0.2	L	0.5		0.09	L	0.5		7.4
15	24.9	260	5	3	L	0.01	L	0.1	L	0.5	L	0.2	L	0.5		0.07	L	0.5		6.0
16	23.4	220	4	3	L	0.01	L	0.1	L	0.5	L	0.2	L	0.5		0.05	L	0.5		6.0
17	22.0	180	5	3		0.01	L	0.1	L	0.5	L	0.2	L	0.5		0.06	L	0.5		5.4
18	21.8	160	4	3		0.03	L	0.1	L	0.5	L	0.2	L	0.5		0.05	L	0.5		7.0
19	22.0	200	5	2		0.01	L	0.1	L	0.5	L	0.2	L	0.5		0.08	L	0.5		6.0
20	21.9	160	4	3		0.03	L	0.1	L	0.5	L	0.2	L	0.5		0.07	L	0.5		5.6
21	20.6	110	4	2		0.02	L	0.1	L	0.5	L	0.2	L	0.5		0.09	L	0.5		6.0

Appendix 1(d)

YEAR=1984 SITE=LAKE DAUPHIN SPECIES=COMMON SUCKER

---------- YEAR=84 SITE=BM037 SPECIES=21 ----------

OBS	LENGTH	WEIGHT	AGE	SEX	***** AS(M)		***** CD(M)		***** CR(M)	***** CU(M)		***** PB(M)		***** HG(M)		***** NI(M)	***** ZN(M)
1	39.0	940	4	3	0.01	L	0.1	L	0.5	0.6	L	0.5		0.02	L	0.5	5.6
2	34.3	610	3	2	0.04	L	0.1	L	0.5	0.3	L	0.5		0.08	L	0.5	4.8
3	38.7	820	5	3	0.05	L	0.1	L	0.5	0.3	L	0.5		0.03	L	0.5	4.6
4	39.4	1000	9	3	0.03	L	0.1	L	0.5	0.4	L	0.5		0.07	L	0.5	4.0
5	29.3	440	2	1	0.08	L	0.1	L	0.5	0.6	L	0.5		0.02	L	0.5	4.6
6	39.2	900	6	3	0.05	L	0.1	L	0.5	0.5	L	0.5		0.04	L	0.5	5.0
7	34.0	730	5	2	0.08	L	0.1	L	0.5	0.7	L	0.5		0.03	L	0.5	6.2
8	33.9	650	4	2	0.03	L	0.1	L	0.5	0.4	L	0.5	L	0.02	L	0.5	4.1
9	33.2	680	8	2	0.03	L	0.1	L	0.5	0.8	L	0.5		0.03	L	0.5	4.1
10	38.9	920	5	3	0.05	L	0.1	L	0.5	0.3	L	0.5		0.05	L	0.5	4.0
11	34.8	620	5	4	0.03	L	0.1	L	0.5	0.8	L	0.5		0.03	L	0.5	5.1
12	37.5	660	4	2	0.02	L	0.1	L	0.5	0.5	L	0.5		0.03	L	0.5	3.7
13	35.5	660	4	1	0.04	L	0.1	L	0.5	0.3	L	0.5		0.06	L	0.5	4.9
14	38.2	860	7	3	0.06	L	0.1	L	0.5	0.8	L	0.5		0.04	L	0.5	3.6
15	38.1	780	6	3	0.06	L	0.1	L	0.5	0.4	L	0.5		0.04	L	0.5	4.7
16	35.2	720	5	2	0.05	L	0.1	L	0.5	0.3	L	0.5		0.02	L	0.5	4.1
17	33.9	710	4	4	0.06	L	0.1	L	0.5	0.9	L	0.5		0.06	L	0.5	4.5
18	42.9	1160	6	3	0.11	L	0.1	L	0.5	0.3	L	0.5		0.07	L	0.5	3.8
19	34.2	680	5	3	0.06	L	0.1	L	0.5	0.7	L	0.5		0.04	L	0.5	5.6
20	35.2	740	5	2	0.03	L	0.1	L	0.5	0.3	L	0.5		0.03	L	0.5	3.9
21	35.0	780	5	2	0.03	L	0.1	L	0.5	0.3	L	0.5		0.02	L	0.5	3.2
22	37.6	850	5	3	0.04	L	0.1	L	0.5	0.3	L	0.5		0.04	L	0.5	5.2
23	33.9	660	5	3	0.04	L	0.1	L	0.5	0.4	L	0.5		0.02	L	0.5	4.0
24	34.9	720	5	2	0.04	L	0.1	L	0.5	0.3	L	0.5		0.02	L	0.5	4.0
25	33.7	800	6	2	0.04	L	0.1	L	0.5	0.3	L	0.5	L	0.02	L	0.5	4.8

Appendix 1(e)

YEAR=1984 SITE=LAKE DAUPHIN SPECIES=SHORTHEAD REDHORSE SUCKER

---------- YEAR=84 SITE=BM037 SPECIES=22 ----------

OBS	LENGTH	WEIGHT	AGE	SEX	*****	AS(M)	*****	CD(M)	*****	CR(M)	*****	CU(M)	*****	PB(M)	*****	HG(M)	*****	NI(M)	*****	ZN(M)
1	35.2	630	8	3		0.09	L	0.1	L	0.5		0.3	L	0.5		0.09	L	0.5		5.2
2	35.8	720	8	2		0.10	L	0.1	L	0.5		0.4	L	0.5		0.06	L	0.5		7.6
3	31.7	480	5	4		0.08	L	0.1	L	0.5		0.3	L	0.5		0.05	L	0.5		5.4
4	31.7	500	6	2		0.11	L	0.1	L	0.5		0.4	L	0.5		0.07	L	0.5		6.2
5	31.6	510	5	2		0.08	L	0.1	L	0.5		0.5		0.5		0.05	L	0.5		5.4
6	30.6	460	5	2		0.12	L	0.1	L	0.5		0.3	L	0.5		0.04	L	0.5		5.6
7	28.3	340	4	1		0.10	L	0.1	L	0.5		0.3	L	0.5		0.03	L	0.5		5.8
8	33.0	700	7	2		0.10	L	0.1	L	0.5	L	0.2	L	0.5		0.06	L	0.5		4.0
9	32.7	560	5	3		0.08	L	0.1	L	0.5		0.6		0.5		0.05	L	0.5		5.8
10	33.5	600	4	3		0.09	L	0.1	L	0.5		0.5	L	0.5		0.03	L	0.5		3.6
11	36.2	880	7	3		0.07	L	0.1	L	0.5		0.4	L	0.5		0.07	L	0.5		4.2
12	36.5	740	9	2		0.06	L	0.1	L	0.5		0.6	L	0.5		0.07	L	0.5		6.0
13	39.0	960	9	3		0.08	L	0.1	L	0.5		0.6	L	0.5		0.07	L	0.5		4.2
14	27.5	360	4	3		0.08	L	0.1	L	0.5		0.3	L	0.5		0.03	L	0.5		4.6
15	35.2	740	6	3		0.08	L	0.1	L	0.5		0.4	L	0.5		0.05	L	0.5		6.0
16	28.2	380	4	2		0.07	L	0.1	L	0.5	L	0.2	L	0.5		0.05	L	0.5		6.4
17	28.0	400	3	2		0.09	L	0.1	L	0.5	L	0.2	L	0.5		0.04	L	0.5		4.5
18	30.2	400	4	2		0.09	L	0.1	L	0.5	L	0.2	L	0.5		0.03	L	0.5		5.4
19	39.2	970	12	2		0.09	L	0.1	L	0.5	L	0.2	L	0.5		0.20	L	0.5		6.0
20	31.8	500	4	2		0.10	L	0.1	L	0.5	L	0.2	L	0.5		0.06	L	0.5		3.9
21	26.1	320	4	1		0.10	L	0.1	L	0.5	L	0.2	L	0.5		0.02	L	0.5		4.3

Appendix 1(f)

YEAR=1984 SITE=LAKE DAUPHIN SPECIES=CISCO

---------- YEAR=84 SITE=BM037 SPECIES=10 ----------

OBS	LENGTH	WEIGHT	AGE	SEX	*****	AS(M)	*****	CD(M)	*****	CR(M)	*****	CU(M)	*****	PB(M)	*****	HG(M)	*****	NI(M)	*****	ZN(M)
1	24.8	280	6	2		0.16	L	0.1	L	0.5		0.50	L	0.5	L	0.02	L	0.5		9.4
2	25.6	340	6	3		0.28	L	0.1	L	0.5		0.40		0.5		0.02	L	0.5		8.2
3	27.2	400	5	2		0.16	L	0.1	L	0.5		0.40	L	0.5	L	0.02	L	0.5		5.6
4	24.7	300	5	3		0.19	L	0.1	L	0.5		0.40	L	0.5	L	0.02	L	0.5		5.8
5	26.1	300	4	2		0.13	L	0.1	L	0.5		0.70	L	0.5		0.03	L	0.5		7.2
6	23.2	250	5	3		0.07	L	0.1	L	0.5		0.50	L	0.5	L	0.02	L	0.5		7.2
7	27.3	400	5	3		0.12	L	0.1	L	0.5		0.60	L	0.5		0.02	L	0.5		8.0
8	27.2	300	5	2		0.11	L	0.1	L	0.5		0.70	L	0.5	L	0.02	L	0.5		6.8
9	25.1	280	6	2		0.10	L	0.1	L	0.5		0.60	L	0.5	L	0.02	L	0.5		5.0
10	24.2	240	6	3		0.16	L	0.1	L	0.5	L	0.20	L	0.5		0.02	L	0.5		10.8
11	23.5	220	4	3		0.15	L	0.1	L	0.5		0.30	L	0.5	L	0.02	L	0.5		9.6
12	22.2	210	3	2		0.14	L	0.1	L	0.5		0.30	L	0.5	L	0.02	L	0.5		5.6

APPENDIX II

PAGE

2. Organochlorine Residues in Fish from Lake Dauphin, 1984:

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- 2(e): Shorthead Redhorse Sucker..... 27
- 2(f): Cisco..... 28

KEY TO SYMBOLS

OBS - observation or specimen number

LENGTH - expressed in centimetres

WEIGHT - expressed in grams

AGE - expressed in years

SEX - expressed numerically where 1 = immature, 2 = male, 3 = female, 4 = regenerate

< - symbol for "less than"; indicates limit of detection

NOTE - A synopsis of organochlorine terms used is contained in Appendix III

- Residues are expressed in µg/g (micrograms per gram, which are equivalent to "parts per million").

Appendix 2(a)

YEAR=1984 SITE=LAKE DAUPHIN SPECIES=WALLEYE

---------- YEAR=84 SITE=BM037 SPECIES=17 ----------

OBS	LENGTH	WEIGHT	AGE	SEX	***** A-1248	***** A-1254	***** A-1260	***** ALDRIN	***** CHLORDANE	***** DIELDRIN	***** ENDRIN *****
1	42.1	880	5	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L
2	42.9	1080	5	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L
3	46.2	1200	5	2	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L
4	43.3	1010	5	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L
5	43.5	1040	5	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L
6	45.2	1270	5	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L
7	44.1	1130	5	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L
8	44.1	1090	5	2	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L
9	44.6	1120	5	2	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L
10	42.8	960	5	2	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L
11	45.3	1410	5	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L
12	59.3	2660	10	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L
13	44.2	1140	5	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L
14	38.7	760	4	2	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L
15	43.2	1060	5	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
16	41.6	920	4	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L
17	44.9	1150	5	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
18	49.2	1480	6	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L
19	42.7	1100	5	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L
20	41.6	1080	6	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L
21	43.8	980	6	4	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
22	44.2	1400	5	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0005	L 0.0009 L
23	46.5	1260	5	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L
24	44.8	1200	5	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
25	20.2	120	1	1	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0004	L 0.0009 L

OBS	LINDANE *****	METHOXYCHLOR *****	TOTAL-DDT *****	OP-DDE *****	PP-DDE *****	OP-DDD *****	PP-DDD *****	OP-DDT *****	PP-DDT
1	0.0002 L	0.004	0.0018	L 0.0004	0.0018	L 0.0008	L 0.0010	L 0.0008	L 0.001
2	0.0002 L	0.004	0.0010	L 0.0004	0.0010	L 0.0008	L 0.0010	L 0.0008	L 0.001
3	0.0002 L	0.004	0.0009	L 0.0004	0.0009	L 0.0008	L 0.0010	L 0.0008	L 0.001
4	0.0002 L	0.004	0.0037	L 0.0004	0.0025	L 0.0008	0.0012	L 0.0008	L 0.001
5	0.0002 L	0.004	0.0011	L 0.0004	0.0011	L 0.0008	L 0.0010	L 0.0008	L 0.001
6	0.0002 L	0.004	0.0008	L 0.0004	0.0008	L 0.0008	L 0.0010	L 0.0008	L 0.001
7	0.0002 L	0.004	0.0013	L 0.0004	0.0013	L 0.0008	L 0.0010	L 0.0008	L 0.001
8	0.0002 L	0.004	0.0017	L 0.0004	0.0017	L 0.0008	L 0.0010	L 0.0008	L 0.001
9	0.0002 L	0.004	0.0033	L 0.0004	0.0023	L 0.0008	0.0010	L 0.0008	L 0.001
10	0.0002 L	0.004	0.0042	L 0.0004	0.0031	L 0.0008	0.0011	L 0.0008	L 0.001
11	0.0002 L	0.004	0.0013	L 0.0004	0.0013	L 0.0008	L 0.0010	L 0.0008	L 0.001
12	0.0002 L	0.004	0.0017	L 0.0004	0.0017	L 0.0008	L 0.0010	L 0.0008	L 0.001
13	0.0002 L	0.004	0.0009	L 0.0004	0.0009	L 0.0008	L 0.0010	L 0.0008	L 0.001
14	0.0002 L	0.004	0.0009	L 0.0004	0.0009	L 0.0008	L 0.0010	L 0.0008	L 0.001
15	0.0002 L	0.004	0.0013	L 0.0004	0.0013	L 0.0008	L 0.0010	L 0.0008	L 0.001
16	0.0002 L	0.004	0.0012	L 0.0004	0.0012	L 0.0008	L 0.0010	L 0.0008	L 0.001
17	0.0002 L	0.004	0.0010	L 0.0004	0.0010	L 0.0008	L 0.0010	L 0.0008	L 0.001
18	0.0002 L	0.004	0.0024	L 0.0004	0.0013	L 0.0008	0.0011	L 0.0008	L 0.001
19	0.0002 L	0.004	0.0009	L 0.0004	0.0009	L 0.0008	L 0.0010	L 0.0008	L 0.001
20	0.0002 L	0.004	0.0010	L 0.0004	0.0010	L 0.0008	L 0.0010	L 0.0008	L 0.001
21	0.0002 L	0.004	0.0037	L 0.0004	0.0024	L 0.0008	0.0013	L 0.0008	L 0.001
22	0.0002 L	0.004	0.0008	L 0.0004	0.0008	L 0.0008	L 0.0010	L 0.0008	L 0.001
23	0.0002 L	0.004	0.0006	L 0.0004	0.0006	L 0.0008	L 0.0010	L 0.0008	L 0.001
24	0.0002 L	0.004	0.0010	L 0.0004	0.0010	L 0.0008	L 0.0010	L 0.0008	L 0.001
25	0.0002 L	0.004	0.0009	L 0.0004	0.0009	L 0.0008	L 0.0010	L 0.0008	L 0.001

Appendix 2(b)

YEAR=1984 SITE=LAKE DAUPHIN SPECIES=NORTHERN PIKE

---------- YEAR=84 SITE=BM037 SPECIES=25 ----------

OBS	LENGTH	WEIGHT	AGE	SEX	*****	A-1248	*****	A-1254	*****	A-1260	*****	ALDRIN	*****	CHLORDANE	*****	DIELDRIN	*****	ENDRIN	*****
1	50.5	860	4	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
2	53.4	1160	4	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
3	50.6	1000	3	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
4	52.0	930	5	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
5	51.2	1010	4	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
6	53.1	1100	4	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
7	44.3	700	3	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
8	48.6	900	4	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
9	47.0	740	4	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
10	52.8	1060	4	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
11	45.3	600	3	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
12	55.5	1220	6	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
13	51.2	960	4	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
14	45.8	720	3	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
15	49.0	900	5	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
16	54.0	1140	4	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
17	49.3	880	5	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
18	49.6	950	4	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
19	48.6	1000	5	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
20	53.0	1080	4	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
21	50.4	860	4	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
22	52.3	980	7	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
23	47.0	800	3	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L

OBS	LINDANE	*****	METHOXYCHLOR	*****	TOTAL-DDT	*****	OP-DDE	*****	PP-DDE	*****	OP-DDD	*****	PP-DDD	*****	OP-DDT	*****	PP-DDT
1	0.0002	L	0.004		0.0004	L	0.0004		0.0004	L	0.0008	L	0.001	L	0.0008	L	0.001
2	0.0002	L	0.004		0.0005	L	0.0004		0.0005	L	0.0008	L	0.001	L	0.0008	L	0.001
3	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
4	0.0002	L	0.004		0.0005	L	0.0004		0.0005	L	0.0008	L	0.001	L	0.0008	L	0.001
5	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
6	0.0002	L	0.004		0.0018	L	0.0004		0.0018	L	0.0008	L	0.001	L	0.0008	L	0.001
7	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
8	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
9	0.0002	L	0.004		0.0009	L	0.0004		0.0009	L	0.0008	L	0.001	L	0.0008	L	0.001
10	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
11	0.0002	L	0.004		0.0008	L	0.0004		0.0008	L	0.0008	L	0.001	L	0.0008	L	0.001
12	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
13	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
14	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
15	0.0002	L	0.004		0.0005	L	0.0004		0.0005	L	0.0008	L	0.001	L	0.0008	L	0.001
16	0.0002	L	0.004		0.0012	L	0.0004		0.0012	L	0.0008	L	0.001	L	0.0008	L	0.001
17	0.0002	L	0.004		0.0013	L	0.0004		0.0013	L	0.0008	L	0.001	L	0.0008	L	0.001
18	0.0002	L	0.004		0.0021	L	0.0004		0.0021	L	0.0008	L	0.001	L	0.0008	L	0.001
19	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
20	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
21	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
22	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
23	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001

Appendix 2(c)

YEAR=1984 SITE=LAKE DAUPHIN SPECIES=YELLOW PERCH

---------- YEAR=84 SITE=BM037 SPECIES=16 ----------

OBS	LENGTH	WEIGHT	AGE	SEX	*****	A-1248	*****	A-1254	*****	A-1260	*****	ALDRIN	*****	CHLORDANE	*****	DIELDRIN	*****	ENDRIN	*****
1	27.0	350	8	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
2	23.8	250	5	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
3	25.0	320	5	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
4	23.5	220	5	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
5	22.8	200	4	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
6	24.9	260	3	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
7	22.4	220	5	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
8	23.0	220	4	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
9	24.2	220	7	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
10	22.7	230	5	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
11	22.9	220	4	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
12	23.8	250	5	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
13	23.3	210	4	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
14	22.3	200	6	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
15	24.9	260	5	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
16	23.4	220	4	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
17	22.0	180	5	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
18	21.8	160	4	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
19	22.0	200	5	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
20	21.9	160	4	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
21	20.6	110	4	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L

OBS	LINDANE	*****	METHOXYCHLOR	*****	TOTAL-DDT	*****	OP-DDE	*****	PP-DDE	*****	OP-DDD	*****	PP-DDD	*****	OP-DDT	*****	PP-DDT
1	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
2	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
3	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
4	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
5	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
6	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
7	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
8	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
9	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
10	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
11	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
12	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
13	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
14	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
15	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
16	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
17	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
18	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
19	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
20	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
21	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001

Appendix 2(d)

YEAR=1984 SITE=LAKE DAUPHIN SPECIES=COMMON SUCKER

---------- YEAR=84 SITE=BM037 SPECIES=21 ----------

OBS	LENGTH	WEIGHT	AGE	SEX	*****	A-1248	*****	A-1254	*****	A-1260	*****	ALDRIN	*****	CHLORDANE	*****	DIELDRIN	*****	ENDRIN	*****
1	39.0	940	4	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
2	34.3	610	3	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
3	38.7	820	5	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
4	39.4	1000	9	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
5	29.3	440	2	1	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
6	39.2	900	6	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
7	34.0	730	5	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
8	33.9	650	4	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
9	33.2	680	8	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
10	38.9	920	5	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
11	34.8	620	5	4	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
12	37.5	660	4	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
13	35.5	660	4	1	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
14	38.2	860	7	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
15	38.1	780	6	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
16	35.2	720	5	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
17	33.9	710	4	4	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
18	42.9	1160	6	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
19	34.2	680	5	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
20	35.2	740	5	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
21	35.0	780	5	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
22	37.6	850	5	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
23	33.9	660	5	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
24	34.9	720	5	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
25	33.7	800	6	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L

OBS	LINDANE	*****	METHOXYCHLOR	*****	TOTAL-DDT	*****	OP-DDE	*****	PP-DDE	*****	OP-DDD	*****	PP-DDD	*****	OP-DDT	*****	PP-DDT
1	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
2	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
3	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
4	0.0002	L	0.004		0.0018	L	0.0004		0.0018	L	0.0008	L	0.001	L	0.0008	L	0.001
5	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
6	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
7	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
8	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
9	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
10	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
11	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
12	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
13	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
14	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
15	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
16	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
17	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
18	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
19	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
20	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
21	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
22	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
23	0.0002	L	0.004		0.0007	L	0.0004		0.0007	L	0.0008	L	0.001	L	0.0008	L	0.001
24	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
25	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001

Appendix 2(e)

YEAR=1984 SITE=LAKE DAUPHIN SPECIES=SHORTHEAD REDHORSE SUCKER

---------- YEAR=84 SITE=BM1037 SPECIES=22 ----------

OBS	LENGTH	WEIGHT	AGE	SEX	***** A-1248 *****	***** A-1254 *****	***** A-1260 *****	***** ALDRIN *****	***** CHLORDANE *****	***** DIELDRIN *****	***** ENDRIN *****
1	35.2	630	8	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
2	35.8	720	8	2	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
3	31.7	480	5	4	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
4	31.7	500	6	2	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
5	31.6	510	5	2	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
6	30.6	460	5	2	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
7	28.3	340	4	1	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
8	33.0	700	7	2	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	0.0007	L 0.0009 L
9	32.7	560	5	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
10	33.5	600	4	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
11	36.2	880	7	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
12	36.5	740	9	2	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
13	39.0	960	9	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
14	27.5	360	4	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
15	35.2	740	6	3	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
16	28.2	380	4	2	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
17	28.0	400	3	2	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
18	30.2	400	4	2	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
19	39.2	970	12	2	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
20	31.8	500	4	2	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L
21	26.1	320	4	1	L 0.006	L 0.006	L 0.006	L 0.0002	L 0.0003	L 0.0004	L 0.0009 L

OBS	LINDANE *****	METHOXYCHLOR *****	TOTAL-DDT *****	OP-DDE *****	PP-DDE *****	OP-DDD *****	PP-DDD *****	OP-DDT *****	PP-DDT
1	0.0002 L	0.004 L	0.0003 L	0.0004 L	0.0003 L	0.0008 L	0.001 L	0.0008 L	0.001
2	0.0002 L	0.004	0.0005 L	0.0004	0.0005 L	0.0008 L	0.001 L	0.0008 L	0.001
3	0.0002 L	0.004 L	0.0003 L	0.0004 L	0.0003 L	0.0008 L	0.001 L	0.0008 L	0.001
4	0.0002 L	0.004 L	0.0003 L	0.0004 L	0.0003 L	0.0008 L	0.001 L	0.0008 L	0.001
5	0.0002 L	0.004 L	0.0003 L	0.0004 L	0.0003 L	0.0008 L	0.001 L	0.0008 L	0.001
6	0.0002 L	0.004 L	0.0003 L	0.0004 L	0.0003 L	0.0008 L	0.001 L	0.0008 L	0.001
7	0.0002 L	0.004 L	0.0003 L	0.0004 L	0.0003 L	0.0008 L	0.001 L	0.0008 L	0.001
8	0.0002 L	0.004	0.0019 L	0.0004	0.0019 L	0.0008 L	0.001 L	0.0008 L	0.001
9	0.0002 L	0.004	0.0009 L	0.0004	0.0009 L	0.0008 L	0.001 L	0.0008 L	0.001
10	0.0002 L	0.004 L	0.0003 L	0.0004 L	0.0003 L	0.0008 L	0.001 L	0.0008 L	0.001
11	0.0002 L	0.004	0.0010 L	0.0004	0.0010 L	0.0008 L	0.001 L	0.0008 L	0.001
12	0.0002 L	0.004	0.0013 L	0.0004	0.0013 L	0.0008 L	0.001 L	0.0008 L	0.001
13	0.0002 L	0.004	0.0007 L	0.0004	0.0007 L	0.0008 L	0.001 L	0.0008 L	0.001
14	0.0002 L	0.004	0.0007 L	0.0004	0.0007 L	0.0008 L	0.001 L	0.0008 L	0.001
15	0.0002 L	0.004 L	0.0003 L	0.0004 L	0.0003 L	0.0008 L	0.001 L	0.0008 L	0.001
16	0.0002 L	0.004 L	0.0003 L	0.0004 L	0.0003 L	0.0008 L	0.001 L	0.0008 L	0.001
17	0.0002 L	0.004 L	0.0003 L	0.0004 L	0.0003 L	0.0008 L	0.001 L	0.0008 L	0.001
18	0.0002 L	0.004 L	0.0003 L	0.0004 L	0.0003 L	0.0008 L	0.001 L	0.0008 L	0.001
19	0.0002 L	0.004 L	0.0003 L	0.0004 L	0.0003 L	0.0008 L	0.001 L	0.0008 L	0.001
20	0.0002 L	0.004 L	0.0003 L	0.0004 L	0.0003 L	0.0008 L	0.001 L	0.0008 L	0.001
21	0.0002 L	0.004 L	0.0003 L	0.0004 L	0.0003 L	0.0008 L	0.001 L	0.0008 L	0.001

Appendix 2(f)

YEAR=1984 SITE=LAKE DAUPHIN SPECIES=CISCO

---------- YEAR=84 SITE=BM037 SPECIES=10 ----------

OBS	LENGTH	WEIGHT	AGE	SEX	*****	A-1248	*****	A-1254	*****	A-1260	*****	ALDRIN	*****	CHLORDANE	*****	DIELDRIN	*****	ENDRIN	*****
1	24.8	280	6	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
2	25.6	340	6	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
3	27.2	400	5	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
4	24.7	300	5	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
5	26.1	300	4	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
6	23.2	250	5	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
7	27.3	400	5	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
8	27.2	300	5	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003		0.0005	L	0.0009	L
9	25.1	280	6	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
10	24.2	240	6	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
11	23.5	220	4	3	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L
12	22.2	210	3	2	L	0.006	L	0.006	L	0.006	L	0.0002	L	0.0003	L	0.0004	L	0.0009	L

OBS	LINDANE	*****	METHOXYCHLOR	*****	TOTAL-DDT	*****	OP-DDE	*****	PP-DDE	*****	OP-DDD	*****	PP-DDD	*****	OP-DDT	*****	PP-DDT
1	0.0002	L	0.004		0.0039	L	0.0004		0.0039	L	0.0008	L	0.001	L	0.0008	L	0.001
2	0.0002	L	0.004		0.0018	L	0.0004		0.0018	L	0.0008	L	0.001	L	0.0008	L	0.001
3	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
4	0.0002	L	0.004		0.0023	L	0.0004		0.0023	L	0.0008	L	0.001	L	0.0008	L	0.001
5	0.0002	L	0.004		0.0028	L	0.0004		0.0028	L	0.0008	L	0.001	L	0.0008	L	0.001
6	0.0002	L	0.004	L	0.0003	L	0.0004	L	0.0003	L	0.0008	L	0.001	L	0.0008	L	0.001
7	0.0002	L	0.004		0.0012	L	0.0004		0.0012	L	0.0008	L	0.001	L	0.0008	L	0.001
8	0.0002	L	0.004		0.0033	L	0.0004		0.0033	L	0.0008	L	0.001	L	0.0008	L	0.001
9	0.0002	L	0.004		0.0016	L	0.0004		0.0016	L	0.0008	L	0.001	L	0.0008	L	0.001
10	0.0002	L	0.004		0.0013	L	0.0004		0.0013	L	0.0008	L	0.001	L	0.0008	L	0.001
11	0.0002	L	0.004		0.0013	L	0.0004		0.0013	L	0.0008	L	0.001	L	0.0008	L	0.001
12	0.0002	L	0.004		0.0010	L	0.0004		0.0010	L	0.0008	L	0.001	L	0.0008	L	0.001

APPENDIX III

PAGE

3. Synopsis of organochlorine analytes:*

3(a): PCB..... 30

3(b): Aldrin..... 31

3(c): Chlordane..... 32

3(d): Dieldrin..... 33

3(e): Endrin..... 34

3(f): Lindane..... 35

3(g): Methoxychlor..... 36

3(h): Total - DDT..... 37

3(i): DDE..... 38

3(j): DDD..... 39

3(k): DDT..... 40

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* Compiled from Johnson and Finley (1980), Smith et al (1984), E. Yee (pers. comm), P. Nicolas (pers. comm.) and G. MacGregor (pers. comm.)

** E. Yee, Hazardous and Special Wastes Coordinator, Manitoba Environment and Workplace Safety and Health.
P. Nicolas, Chemist, Organic Analysis, W. H. Ward Technical Services Laboratory.
G. MacGregor, Industry Services Branch, Canada Fisheries and Oceans.

PCB

Chemical names: Polychlorinated biphenyls as
Aroclor 1248
Aroclor 1254
Aroclor 1260
(The latter two digits of each Aroclor number indicate percent chlorine content per formulation).

Alternate names: Arcclor, PCB

Principal use: These industrial chemicals have been widely used as plasticizers and in dielectric fluids.

Comment: Monsanto, the sole North American manufacturer, ceased production in October, 1977. Within Canada, the Environmental Contaminants Act restricts the use of PCB containing equipment in food preparation areas. Manitoba Hydro and Winnipeg Hydro, the primary users of equipment containing PCB within Manitoba, have voluntarily adopted a policy of phasing out such equipment.

Detection Limit: During the period 1978 to 1980 (inclusive) - 0.01 µg/g.
During the period 1981 to present - 0.006 µg/g.

Canada Limit for Fish: 2.0 µg/g.

ALDRIN

Chemical name: 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4-endo-exo-5,8-dimethanonaphthalene.

Alternate names: Aldrin, Aldrite, Aldrosol, CAS-309-00-2, Compound 118, ENT-15949, HHDN, Octalene, Seedrin.

Principal use: Insecticide

Comment: Aldrin has been deregistered for sale in Canada under the Pest Control Products Act.

Detection limit: During the period 1978 to 1980 (inclusive) - 0.002 µg/g.
During the period 1981 to present - 0.0002 µg/g.

Canada Limit for Fish: 0.3 µg/g.

CHLORDANE*

Chemical name: 1,2,4,5,6,7,8,8-Octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methanoindene.

Alternate names: Aspon, Belt, CAS57-75-9, Chlor=dan, Chlor-Kill, Corodane, ENT-9932, Krypclor, Octachlor, Ortho Klor, Synklor, Topiclor 20, Velsicol 1068.

Principal Use: Insecticide

Comment: The Manitoba Department of Agriculture recommends chlordane for the control of strawberry root weevil, various turf insects, ants and crickets.

Detection Limit: During the period 1978 to 1980 (inclusive) - 0.005 µg/g/
During 1981 - 0.0004 µg/g
During the period 1982 to present - 0.0003 µg/g

Canada Limit for Fish: no limit set at present

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* Chlordane residues reported in the present study are summations of the CIS and Trans isomers.

DIELDRIN

Chemical name: 1,2,3,4,10,10-Hexachloro-exo-6,7-epoxy-1,4,4a,5,6,7,8, 8a-octahydro-1,4-endo-exo-5,8-dimethanonaphthalene.

Alternate names: Aluit, CAS60-57-1, Compound 47, Dieldrine, Dieldrite, ENT-16225, HEOD, Octalox, Panoram D-31.

Principal Use: Insecticide

Comment: Dieldrin has been deregistered for sale in Canada under the Pest Control Products Act.

Detection Limit: During the period 1978 to 1980 (inclusive) - 0.001 µg/g
During the period 1981 to present - 0.0004 µg/g

Canada Limit for Fish: 0.3 µg/g

ENDRIN

Chemical name: 1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8, 8a-octahydro-1,4-endo,endo-5,8-dimethanonaphthalene.

Alternate names: CAS-72-20-8, Compound 269, ENT-17251, Hexadrin, Mendrin.

Principal use: Insecticide

Comment: Endrin has been deregistered for sale in Canada under the Pest Control Products Act.

Detection Limit: During the period 1978 to 1980 (inclusive) - 0.005 µg/g
During the period 1981 to present - 0.0009 µg/g.

Canada Limit for Fish: No limit set at present.

LINDANE

Chemical name: Gamma isomer of 1,2,3,4,5,6-hexachlorocyclohexane

Alternate names: Benesan, CAS58-89-9, ENT-7796, Forlin, Gamaphex, Gamma BHC, Gammafog, Gammalin, Gammex, Gammexane, Isotex, Lindafor, Lindagam, Lindamul, Lintox, Novigam, Oko, Silvanol.

Principal use: Insecticide

Comment: The Manitoba Department of Agriculture recommends the use of lindane for a wide range of applications. Recommendations include application for control of a variety of livestock pests such as dog ticks, hog mange mites, lice on cattle, horses, sheep and goats and for control of crop pests such as wireworms, flea beetles and thrips.

Detection limit: During the period 1978 to 1980 (inclusive) - 0.001 µg/g
During the period 1981 to present - 0.0002 µg/g

Canada Limit for Fish: No limit set at present.

METHOXYCHLOR

Chemical name: 2,2-Bis(p-methoxyphenyl)-1,1,1-trichloroethane

Alternate names: CAS72-43-5, Dimethoxy-DT, DMDT, ENT-1716, Marlate, Methoxo, Methoxy-DDT

Principal use: Insecticide

Comment: The Manitoba Department of Agriculture recommends the use of methoxychlor for control of cattle horn flies and a variety of fruit and tree pests such as the tent caterpillar, apple seed chalcid, plum curculio, currant fruit fly, cankerworm and elm bark beetle.

Detection limit: During the period 1978 to 1980 (inclusive) - 0.005 µg/g
During the period 1981 to present - 0.004 µg/g

Canada Limit for Fish: No limit set at present.

TOTAL DDT

Chemical names: refer to DDE, DDD and DDT

Alternate names: refer to DDE, DDD and DDT

Principal use: Insecticide

Comment: Within the context of the present report the term "total DDT" refers to the sum of the ortho, para and para, para isomers of DDE, DDD and DDT.

Detection limit: During the period of 1978 to 1980 (inclusive) - 0.001 µg/g
During the period 1981 to present - 0.0003 µg/g

Canada Limit for Fish: 5.0 µg/g

DDE

Chemical name: Dichloro diphenyl dichlorethylene

Alternate names: none known

Principal uses: Insecticide, degradation product of DDT

Comment: This product occurs as both ortho, para and para, para isomers and is one of the primary metabolites of DDT. It has been deregistered for sale in Canada under the Pest Control Products Act.

Detection limit: During the period 1978 to 1980 (inclusive) - 0.001 µg/g
During the period 1981 to present - 0.0004 µg/g

Canada Limit for Fish: Included in the category of Total DDT, the sum of which is not to exceed 5.0 µg/g.

DDD

Chemical name: dichloro diphenyl dichlorethane

Alternate name: CAS72-54-8, ENT-4225, Rothane, TDE

Principal use: Insecticide

Comment: This product occurs as both ortho, para and para, para isomers and has been deregistered for sale in Canada under the Pest Control Products Act.

Detection limit During the period 1978 to 1980 (inclusive) - 0.002 µg/g
During the period 1981 to present: o,p-DDE - 0.0008 µg/g
:p,p-DDE - 0.001 µg/g

Canada Limit for Fish: Included in the category of "Total DDT", the sum of which is not to exceed 5.0 µg/g

DDT

Chemical name: dichloro diphenyl trichloroethane

Alternate names: Anofax, CAS50-29-3, Chlorophenothane, Dedelo, Didimac, ENT-1506, Geritox, Gesapon, Gesasex, Gesarol, Gyron, Ixodex, Kopool, Neocid, Pentachlorin, Ruksean, Zerdane.

Principal use: Insecticide

Comment: This product occurs as both the orth, para and para, para isomers and has been deregistered for sale in Canada under the Pest Control Products Act.

Detection limit: During the period 1978 to 1980 (inclusive) - 0.002 µg/g
During the period 1981 to present: o,p-DDE - 0.0008 µg/g
:p,p-DDE - 0.001 µg/g

Canada Limit for Fish: Included in the category of "Total DDT", the sum of which is not to exceed 5.0 µg/g